

fusion of the two nuclei is delayed, the male pro-nucleus as it grows and gradually assumes a less dense appearance, approximates more and more in its staining reaction to that of the female pro-nucleus. Nevertheless, it might also be argued that the very state of dense aggregation implies a chemical difference, especially when it is recollected that growth perhaps involves much more than mere expansion of bulk.

But it must not be supposed that the evidence adduced is everywhere immediately favourable to the author's standpoint. There are, in fact, many anomalies, especially in the case of certain basic dyes, which require to be cleared up before Dr. Fischer's views can command universal acceptance. It is, however, as has been already said, impossible to do justice to this part of his book within the limits of a single article. But as the facts adduced will be largely new to most cytologists, it has been thought best to utilise the available space in pointing out a few lines of the argument rather than, by venturing on detailed criticism, to trespass on the domain of the chemist or physicist.

By no means the least interesting part of the book is that devoted to an inquiry into the origin of cell-structure, spindle-fibres, centrosomes, and the like. As regards the spindle-radiations, the results of some remarkable experiments are detailed, and these are quite startling owing to the apparent fidelity with which certain of the most characteristic features of cellular activity have been successfully imitated. Other investigators have produced, ere now, appearances resembling the achromatic spindle, but the figures have never attracted serious attention, as the analogies between them and a protoplasmic structure appeared to be too feeble. In the present case, however, it is very different, since the materials employed are akin to those which exist in the cell.

By injecting elder-pith with sundry colloids (albumen, albumose, &c.), and then treating sections of the pith with various fixatives, the author succeeded in obtaining spindle structures closely resembling those exhibited in a preparation showing karyokinetic figures. Not only this, but it has been found possible to ascertain at least some of the conditions which are necessary to their formation.

In the first place, there must be present in the cell some foreign indifferent body which may serve as a centre from which the radiations may start. Such a body is often provided in the dead but persistent fragment of the original cell-nucleus. Secondly, the precipitating action of the reagent must be slower than its penetrative power—it must have completely saturated the fixable substance as far as to the foreign body, before the physical change of precipitation sets in. Unless these conditions are both complied with, no radiations will arise. The importance of the second point at once becomes apparent when one recollects the emphasis laid on *rapidity of penetration* as one of the essentials of a good "fixative," and an analogy between the first condition and the origin of spindle fibres is seen in those multipolar spindles associated with large heterogeneous bodies in the cell protoplasm, which were first pointed out by the present writer in 1893, and which have since been confirmed by Mottier and many

other investigators. Similar results were also obtained by allowing fixatives to diffuse from capillary tubes into the fixable proteids; the radiations then started from the surface of the concentrated drop of fixative in such a way as to simulate the appearance of an attraction sphere.

The author exercises an admirable restraint in instituting comparisons between these results and those observed in preparations of cells, but it must not be forgotten that there is reason to believe that substances very similar to, if not identical with, those employed by him do really exist at least in the killed cell.

Naturally much is still left obscure. Why, it may be asked, should the precipitates only take the form of radiations during mitosis? If we attempt to frame an answer temporarily satisfactory on chemical or even microchemical grounds, we should have to trek into regions far outlying the limits of our present knowledge.

A discussion of cytological phenomena and of the various theories of protoplasmic structure and its supposed mechanism, occupies the remainder of the volume. The centrosome in particular comes in for a lengthy criticism, especially as regards those alleged for the higher plants. The author, on good grounds, concludes that these are merely cast out nucleoli, or, at any rate, in no sense to be regarded as special cell organs. He points out the fallacies which have led to the obscuring of the true issues in the past, and he treats the well-known case of *Lilium* with special severity.

It will be apparent that Prof. Fischer's book is not only startling from the novelty of its contents, but it is even almost revolutionary in its tendencies. But the cytologist need not be unduly alarmed, nor fancy that all his tenderly nurtured theories must of necessity dissolve forthwith into vapour. Probably much of the "structure," which was believed in by the extreme adherents of the particulate school may turn out to be due to *post-mortem* effects, and to possess no counterpart during the life of the cell; but the broad distinctions of cytological structure will still hold good, even though they may not be able to support the weight of the theories that have been erected upon them. The chromosomes, the spindle-fibres, the centrospheres (where apparent) all represent definite facts of protoplasmic activity, although the conclusions which have been drawn respecting them may stand in need of revision. But it is well that we have been thus recalled to examine once again, and more minutely than heretofore, the very foundations on which our knowledge of cell phenomena rest. *Diligenter explorata principia ponantur.*

J. B. FARMER.

RESEARCH IN PREVENTIVE MEDICINE.
Transactions of the Jenner Institute of Preventive Medicine (late British Institute of Preventive Medicine). Second Series. Edited by Allan Macfadyen, M.D., B.Sc., Director. Pp. xv + 253. (London: Macmillan and Co., Ltd. New York: the Macmillan Company 1899.)

DURING the last year the Jenner Institute of Preventive Medicine has passed through a most notable phase of evolution; with it has become associated the name of the father of modern preventive medicine, whilst its sphere of usefulness has been

enormously extended through the munificent liberality of Lord Iveagh, who, in placing at the disposal of the Council a sum of no less than a quarter of a million sterling, has shown an example of keen insight into the needs of scientific investigation in this country that must, ere long, have most important results in raising the standard of experimental research in the field of medicine.

From a perusal of the Second Series of the *Transactions*, published some short time ago, it is evident that the increased facilities offered for the carrying on of investigations in the laboratories have already borne abundant fruit, the papers in the present volume being not only more numerous but also relatively of considerably greater importance than those that appeared in the first volume.

The introduction contains a fairly full descriptive account of the laboratories in the various departments in the beautiful building on the Chelsea Embankment, an account which will be of considerable interest to those who would know what has been the development of laboratory accommodation and apparatus during the last few years.

The first paper, from the pen of Prof. Ehrlich, "Observations upon the constitution of the diphtheria toxin," has great value, especially just at the present, as he describes his "toxin spectrum," a careful study of which promises to throw light on the constitution of these most complicated bodies. Dr. William Bulloch also makes a contribution to the study of diphtheria toxins. A new pathogenic streptothrix is described by Dr. George Dean. This organism produces in the horse a disease which might be described clinically as actinomycosis, from which however it differs very considerably in certain important points. He considers that it is much more nearly allied to the bacilli of the diphtheria and tubercle groups than to the moulds, and that actinomycosis is a disease due not to one specific micro-organism, but to a number of allied species. Dr. R. T. Hewlett contributes two papers; one, "Preliminary observations on the occurrence of the bacillus enteritidis sporogenes (Klein) in ulcerative colitis and in the normal dejecta"; the other "On Neisser's diagnostic stain for the diphtheria bacillus." In an article on "the bacteriology of the normal conjunctival sac from a report of 200 cases, and its practical bearing on the utility of antiseptics in ophthalmic surgery," Mr. Arnold Lawson urges the abolition of antiseptics in ophthalmic surgery on the ground that the strongest antiseptic is the healthy conjunctiva itself. He maintains that in order to eliminate suppuration as far as possible from the list of accidents that may occur after operations, only two factors have to be attended to: (1) perfect asepsis on the part of the operator, his instruments, dressings, &c., and (2) the healthy condition of the conjunctival sac. Mr. J. E. Barnard contributes an interesting and ingenious article on photogenic bacteria. He concludes that the different species of phosphorescent bacteria described are probably identical or merely closely allied varieties. They are all markedly pleomorphic, readily undergo involution, and only phosphoresce in the presence of oxygen. The phosphorescent

principle may be kept back by a Berkefeld filter, and anything that affects the vitality of the organism affects likewise the production of light. Dr. Alfred Salter writes "on the pathogenicity of the pseudo-diphtheria bacillus, and its relation to the Klebs-Loeffler organism." He finds that the pseudo-diphtheria bacillus has the power of producing a non-toxic but antitoxin-fixing substance, and he argues that this is an additional fact in favour of the pseudo-diphtheria bacillus and the Klebs-Loeffler bacillus being practically identical. Dr. Arthur Harden, in Part i. of a paper dealing with "the fermentation of sugars by bacillus coli communis and allied organisms," gives a short history of the subject and a number of his own experiments, from which he draws the following conclusions: (1) the organisms that he used, when grown anaerobically in a medium consisting of beef broth alone or in conjunction with peptone, produce inactive lactic acid from the glucose, but may, when a very vigorous growth occurs, produce a small amount of the active laevo-rotatory acid. The lactic acid produced amounts to about 50 per cent. of the weight of sugar decomposed; (2) in media containing peptone but no beef broth, a mixture of the inactive acid with the laevo-lactic acid is formed; (3) the gas produced by the decomposition of the glucose consists of 1 to 1.3 vols. of hydrogen to 1 vol. of carbonic acid gas. Mr. Sydney Rowland, writing on the structure of bacteria, puts forward the thesis that in the actively living bacterial cell no reticular structure can be demonstrated, such reticulum only being present except when the cell is progressing either to spore-formation or to granule-formation. In the actively living cells, which consist of cell wall, cell plasma and granules, the cell wall is a progressive formation and becomes finally a rigid structure. The fine refractile granules staining vividly with roseine may participate in cell-division or may be extruded from the cell through the cell wall. These granules are present even in an embryo on emergence from the spore-case. Drs. Allan Macfadyen and Frank R. Blaxall continue their article on thermophilic bacteria, which are specially important as regards the fermentation in ensilage and the digestion of cellulose.

Mr. G. Harris Morris gives a short account of the technical applications of bacteriology. One of the shortest but most important papers in the whole collection is a record of an experiment carried on with the object of determining the etiology and pathology of cancer. All those interested in this subject will anxiously await further and corroborative evidence of the very striking result obtained by Dr. H. Lambert Lack. Dr. Allan Macfadyen records the important symbiotic fermentation, in which pure cultures of a mould, instead of diastase, are used for the purpose of saccharification and fermentation, thus being accompanied by a pure symbiotic fermentation on the addition of yeast. Dr. Macfadyen corroborates many of Calmette's observations on this point. Mr. Joseph Lunt enumerates and describes a series of eleven organisms of the bacillus *Coli communis* group, which he has been able to isolate from drinking water, &c.; and Dr. Arthur Harden contributes a short note on the action of hydrogen peroxide and the oxides of copper on formaldehyde.

A number of interesting "Laboratory Notes" and "Notes on Apparatus" complete a most creditable volume of transactions. The illustrations, both process blocks and photo-prints, which are very numerous, are all well reproduced.

PHYSICAL PRINCIPLES AND MORAL PRECEPTS.

The Scientific Basis of Morality. By Dr. G. Gore. Pp. viii + 599. (London: Sonnenschein and Co., Ltd., 1899.)

DR. GORE is one of the increasing many who feel that much in conventional morality is baseless, while more is only not crumbling because built up on other foundations than those commonly alleged. Driven to look for salvation to that science in which we perforce believe with the conviction of practical life, he too would lay bare the groundwork of the coming ethics of naturalism.

"About the year 1880 the author published a small book, entitled 'The Scientific Basis of National Progress, including that of Morality.' That book has long been out of print, and having been repeatedly advised to write a more complete statement of the relations of science to morality, &c., he has endeavoured to do so."

Unadvisedly.

Such a book as the present must be the despair of a reviewer who sympathises with its object. If extent of reading within certain well-defined limits and a wide range of interest could make a great book, Dr. Gore's advocacy of the naturalistic basis of ethics, and of the maxim that the laws of science are the chief—nay, the only—guides of life, might be what he claims that it is: a book "largely one for the future," "written in some respects in advance of its time," "for those whose minds are in a fit condition to receive scientific truth." As it is, it is a commonplace book in more senses than one. It is not free from the suspicion of bookmaking. It quotes nearly 350 lines, including three stanzas from the hackneyed "Psalm of Life," of Longfellow; more than 200 lines from Pope. It devotes two whole pages in one place to citations from a fatuous print, entitled "Is Science Guilty?" Many familiar sentences are given at second-hand—e.g. some of Kant's *via* the Archbishop and the Dean of Canterbury. And Dr. Gore is not always either relevant or happy in his quotations. Yet excuse for "the brevity of the treatment" is asked of "those who are competent to investigate the matter" upon the ground of "the great amount of evidence which has been omitted in order to limit the size of the book."

All this notwithstanding, if the kernel of this, which "is not a polished literary treatise, but a scientific production," were of a sound character, we would have to accept it thankfully. But a certain lack of analytical insight makes Dr. Gore's best sections curiously ineffective.

For instance, when our author has pointed out quite correctly that any known or knowable existence must be in relation to us, since it could not otherwise affect us directly or indirectly, and when he has referred with approval to G. H. Lewes, to the effect that there are no relations of the known to the unknowable, though there are to that which is at present unknown, he spoils his

effect by announcing that "man is related to all things," a dictum which loses sight of the scepticism implied in all naturalism, and is as dogmatic as the mythology which Dr. Gore rightly rejects. Phenomenalism, which at the limit can admit of no lacuna, may be a belief or a natural hypothesis. It must not amount to a dogmatic denial of all else.

Again, when Dr. Gore has laid down a determinism which satisfies the demands of science, he proceeds to quote writers with approval, whose doctrine is not his own, but an indeterminism with a limited range. And in treating of evil, he fails to follow out his determinism to its logical consequence, viz., that to call the actual either good or evil is absurd. His proof for the relativity of evil is valid for the relativity of good also, but he preaches the essential optimism of science, continuing to call the world process good, perfect and the like. If Dr. Gore chooses to call the actual as such good, and to say that since there is nothing not actual, evil accordingly is non-existent, he may of course do so. But he solves no problems thereby. When, in treating of pain and of ignorance, he sees that relative ignorance and relative pain, viz. ignorance and pain incident to the stage of progress at any moment attained, are necessary, he surely goes beyond his data in taking the ignorance and the pain as good because any other than the actual would be worse. On his own principles anything other would be impossible; but does not that rather prove the indifference of the actual to that ideal point of view from which we use the relative and partial epithets "good" and "evil"?

Again, Dr. Gore is obscure as to the formula under which he conceives the relation of neurosis to psychosis. He tells us that ideas produce tears, and that mind may be viewed as a mode of energy existing only in nervous substance; while he quotes with approval the famous description of thought as the secretion of brain, just as bile is of the liver. In saying that "mind is dependent upon brain because it is not proved to exist without it," our author seems to state a truth with a false ground for holding it.

Once more, Dr. Gore thinks it an additional argument against Paley's stolen illustration of the watch implying a watchmaker, to say that nearly every part of a watch is now made by means of inanimate machinery, and the watchmaker only puts its pieces together. As if the unity of purpose in the process as a whole and the creative activity back of the machinery itself would not satisfy Paley well enough.

Dr. Gore's rules of conduct according to naturalism might be all summed up under the Stoic formula of life according to nature. His economics are opposed to trades unionism and to united action on the part of the working classes in the direction of shorter working hours. The efficiency-theory of wages which Dr. Gore apparently holds does not give ground for this attitude. Dr. Gore's logic lays too much stress on "induction" of the kind which, as a modern teacher puts it, "takes unanalysed concretes as ultimate."

Much of what Dr. Gore has to say would pass as interesting and thoughtful, though not either original or clearheaded, matter, if put forth in a volume one-quarter the size.

H. W. B.